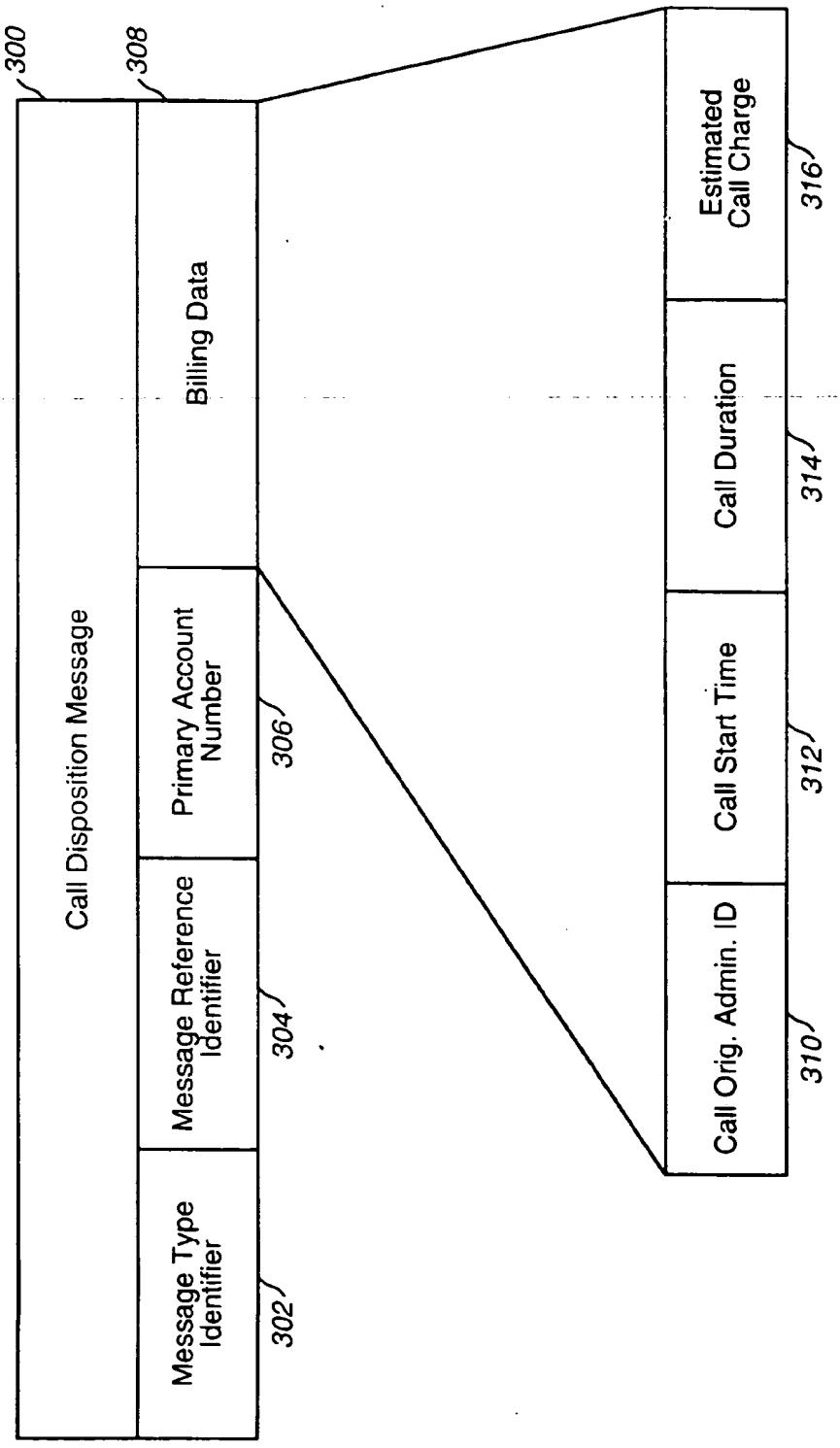
300
308
Call Disposition Message
Billing Data
Message Type Identifier
302
Message Reference Identifier
304
Primary Account Number
306
Call Orig. Admin. ID
310
Call Start Time
312
Call Duration
314
Estimated Call Charge
316

FIG. 3

US-PAT-NO: 6408173

DOCUMENT-IDENTIFIER: US 6408173 B1

TITLE: Billing ID correlation for inter-technology roaming

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Brief Summary Text - BSTX (7):

One of the problems arising with subscribers roaming from a GSM system to a TDMA system involves the inability to track billing information for a GSM subscriber within a TDMA system. This arises because of the differences in the way billing ID information is transmitted within the separate systems. The billing information is necessary in order to correlate a billing record generated in the gateway mobile switching center (GMSC) with a billing record generated in a visited mobile switching center (MSC). Since the billing information formats are different between GSM and TDMA networks (and also GSM networks where TAP is the utilized standard), there exists a need for a system capable of providing billing information when a GSM subscriber roams outside of its home technology network into a system utilizing a differing technology.

Brief Summary Text - BSTX (9):

The present invention overcomes the foregoing and other problems with a system and method for generating a billing identifier for a call to a subscriber from-a GSM network which is presently located within a TDMA or other technology network. A mobility gateway interconnecting the GSM network with the TDMA network receives a call message from the GSM network which does not include a billing identifier. A functionality within the mobility gateway generates a billing identifier enabling billing records within the TDMA network to be associated with the subscriber from the GSM network.

Brief Summary Text - BSTX (10):

The billing identifier includes a mobility gateway switch ID, a mobility gateway switch number and an additional part which identifies the mobile country code and a mobile network code for the subscriber. The mobility gateway transmits the billing identifier to the TDMA network. Later, the mobile country code and mobile network code for the subscriber from the GSM

system may be determined from the billing identifier, and the billing record within the TDMA network associated with the subscriber using this information.

Drawing Description Text - DRTX (3):

FIG. 1 is a functional block diagram illustrating a mobility gateway including the functionality of the present invention between a GSM network and a TDMA network;

Drawing Description Text - DRTX (7):

FIG. 5 illustrates the billing identifier produced by a mobility gateway according to the present invention.

Detailed Description Text - DETX (2):

Referring now to the Drawings, and more particularly to FIG. 1, there is illustrated a block diagram of a GSM network 10 utilizing a GSM MAP protocol interconnected with a TDMA network 15 using a ANSI-41 protocol through a mobility gateway 20. The mobility gateway 20 comprises an inter-system location register (ILR) or inter-working inter-operability function (IIF). The GSM network 10 enables subscribers to access telecommunications functionalities utilizing GSM technologies. The TDMA network enables mobile subscribers to access telecommunications functionalities using TDMA technologies.

Detailed Description Text - DETX (3):

The mobility gateway 20 enables mobile subscribers from the GSM network 20 to roam within the TDMA network 15 and mobile subscribers from the TDMA network to roam within the GSM network 10 while maintaining access to substantially all of the services and functionalities provided to them within their home network. While-the present system is described with respect to interconnections between a TDMA system using the ANSI-41 protocol and a GSM system utilizing a GSM MAP protocol, it should be realized that the mobility gateway 20 and discussions with respect thereto may be extended to include other mobile protocols and networks such that the described system is not limited to use between GSM and TDMA networks.

Detailed Description Text - DETX (7):

A different call set-up procedure, with respect to the treatment of billing information, is illustrated in FIG. 3 for a GSM network. An incoming call message 90 is received at the PSTN 95 which generates an incoming call message

100 to the GSM GMSC 105. In response to the incoming call message 100, the GMSC 105 generates a send routing information request message 110 to a GSM HLR 115. Next, a provide roaming number message 120 is transmitted to the GSM MSC/VLR 125 from the HLR 115. The MSC/VLR 125 responds with a provide roaming number result message 130 to the HLR 115. The HLR 115 transmits a send routing information result message 135 to the GMSC 105. Using this information, a call connection 140 is established between the GMSC 105 and the MSC/VLR 125. In a GSM network, the billing information is generated within the GMSC and transmitted to the MSC/VLR with the call connection 140 on the voice trunk over the ISUP. The "network call reference" parameter within the ISUP IAM message (initial address message) contains the billing information. A call connection 145 may then be established between the MSC/VLR 125 and the GSM subscriber 150.

Detailed Description Text - DETX (9):

Referring now to FIG. 4, there is illustrated a method of the present invention for providing billing information for a GSM subscriber in a TDMA network. In response to an incoming call 155, the PSTN 160 transmits an incoming call message 165 to the GSM GMSC 170. The GMSC 170 transmits a send routing information message 175 to the GSM HLR 180. The HLR 180 transmits a provide roaming number message 185 to the mobility gateway 190. Within the mobility gateway 190, a billing functionality 25 (FIG. 1) generates a billing identification 232 to be included within the routing request message 195 from the mobility gateway 190 to the TDMA MSC/VLR 200. This is necessary because the GSM system has not yet generated any billing information, and the TDMA MSC/VLR 200 expects billing information within the routing request message 195.

Detailed Description Text - DETX (10):

The billing functionality 25 generates the billing identification 232 as illustrated in FIG. 5. The billing identification 232 includes three separate portions; namely, the system identifier 235, the switch number 240, the billing ID number 245, and the segment number 250. The system identifier 235 is two bytes long and includes the mobility gateway switch ID (SID). The switch number 240 is one byte long and includes the mobility gateway switch number. The billing ID number 245 is three bytes long and is based upon the GSM subscriber IMSI number. The billing functionality 25 uses the mobile country code (MCC) and the mobile network code (MNC) of the GSM subscriber to generate a 5 digit billing ID number 245. The remaining digits within the three byte portion are filled with a filler data (e.g., F), if necessary. The segment number 250 is not used and is only 1 byte long. The segment number 250 may be filled with a value such as H'FF. The system identifier and switch number provide information on the mobility gateway switch from which the call

information came. The mobile country code and mobile network code within the billing ID number 245 are used to correlate the billing records of the GSM GMSC and the TDMA MSC to know which subscriber the call should be billed to.

Detailed Description Text - DETX (11):

Referring now back to FIG. 4, once the billing identification 232 has been generated by the billing functionality 25 within the mobility gateway 190, a routing request message 195 including the billing identification is transmitted to the TDMA MSC/VLR 200. The routing request message 195 from the mobility gateway 190 appears to come from a TDMA HLR from the point of view of the TDMA MSC/VLR 200. In response thereto, the MSC/VLR 200 transmits a routing request result message 205 to the mobility gateway 190 which transmits a provide roaming number result message 210 to the GSM HLR 180. Messages to the GSM HLR 180 from the mobility gateway 190 appear to come from a GSM MSC/VLR from the point of view of the GSM HLR. The GSM HLR 180 notifies the GSM GMSC 170 of the roaming number with a send routing information result message 215. A call connection 220 is provided between the GSM GMSC 170 and the TDMA MSC/VLR 200 over a voice trunk. The call connection 220 will necessarily include the billing information over the ISUP, but this information is neither expected nor interpreted by the TDMA MSC/VLR 200. A call connection 225 may then be established between the MSC/VLR 200 and the GSM subscriber 230.

Claims Text - CLTX (7):

4. The apparatus of claim 1, wherein the billing identifier includes a mobility gateway switch ID.

Claims Text - CLTX (8):

5. The apparatus of claim 1, wherein the billing identifier includes a mobility gateway switch number.

Claims Text - CLTX (17):

10. The method of claim 7, wherein the step of generating further comprises the step of generating at least a portion of the billing identifier to include a mobility gateway switch ID.

Claims Text - CLTX (18):

11. The method of claim 7, wherein the step of generating further comprises the step of generating at least a portion of the billing identifier to include

a mobility gateway switch number.

Claims Text - CLTX (20):
13. The method of claim 7, wherein the node comprises a mobility gateway.

Claims Text - CLTX (25):
receiving at a mobility gateway interconnecting the GSM network and the TDMA network a call message from the GSM network which does not include a billing identifier;

Claims Text - CLTX (26):
generating a billing identifier enabling billing records in the TDMA network to be associated with the subscriber from the GSM network, the billing identifier including a mobility gateway switch ID, a mobility gateway switch number and information derived from a mobile country code and a mobile network code for the subscriber; and